

Comprehensive Strategic Business Plan: Forensic Energy Analytics & Fraud Detection Firm

1. Executive Thesis and Strategic Overview

The global energy sector, particularly the upstream oil and gas segment, operates within an environment characterized by high capital intensity, profound information asymmetry, and geological opacity. This unique convergence of factors creates a fertile ground for fraudulent activities, ranging from the historical infamy of physical sample salting to modern, sophisticated schemes involving digital data manipulation and reserve inflation. The proposed business venture—a specialized forensic consulting firm dedicated to verifying the integrity of geological and technical reports for lease acquisitions—addresses a critical, underserved niche in the energy investment value chain.

Investors, ranging from family offices and non-operated asset managers to private equity firms, frequently lack the internal technical capability to independently verify the raw data presented in prospectuses. They rely heavily on the assumption that the technical exhibits—core photographs, well logs, and decline curve projections—are authentic representations of the asset. However, as digital tools for image manipulation have become ubiquitous, the barrier to entry for fabricating "Tier 1" geological data has lowered significantly. The proposed firm, hereinafter referred to as "Veritas Geo-Forensics" (a placeholder identifier for this strategic plan), will leverage a proprietary database of authenticated "truth data" to algorithmically and forensically detect anomalies in deal flow documentation.

This comprehensive business plan evaluates the market opportunity, technical architecture, and operational requirements for establishing this firm. A central focus of this analysis is the regulatory landscape within the State of Texas, specifically regarding the interplay between Professional Engineering (P.E.), Professional Geoscientist (P.G.), and Private Investigation (P.I.) licensure. The analysis concludes that while the founder's existing Electrical P.E. license establishes a baseline of professional credibility, it is legally insufficient to authorize the public practice of geoscience or the conduct of fraud investigations outside the scope of engineering. Therefore, a strategic pivot toward "Data Integrity Verification" combined with specific certifications, such as the Certified Fraud Examiner (CFE), is recommended to navigate the complex statutory environment while delivering high-value risk mitigation services to the capital markets.

1.1 The Market Gap: Information Asymmetry in Asset Acquisitions

The current due diligence process for oil and gas asset acquisitions is bifurcated. On one side, financial due diligence focuses on title chains, revenue run-checks, and lease validity—tasks often performed by landmen and attorneys. On the other side, technical due diligence focuses on future production potential, performed by reservoir engineers and geologists.

A dangerous gap exists between these two silos: the verification of the *source data's authenticity*. Traditional technical due diligence assumes the provided data is genuine. A reservoir engineer will run a decline curve analysis on the production data provided; they rarely investigate whether the production CSV file itself was manipulated before delivery. Similarly, a geologist will interpret the depositional environment shown in a core photo; they rarely check if that specific photo was lifted from a different well drilled ten years prior in a different basin.

Veritas Geo-Forensics aims to fill this gap by applying the principles of digital forensics—typically reserved for cybercrime or criminal proceedings—to the specific document sets used in energy

transactions. By aggregating millions of "known good" data points (authenticated filings from state regulators like the North Dakota Industrial Commission and the Texas Railroad Commission) and comparing deal documents against this immutable baseline, the firm provides an objective "truth check" that purely subjective technical interpretation cannot offer.

2. Regulatory Landscape and Licensure Strategy

Navigating the regulatory framework in Texas is the single most significant operational risk for this venture. The State of Texas maintains distinct, legally enforcing silos for the practice of Engineering, Geoscience, and Private Investigation. The founder's current status as a licensed Professional Engineer (Electrical) provides certain privileges but also imposes strict limitations that must be understood to avoid civil and criminal penalties for the unlicensed practice of other professions.

2.1 The Texas Engineering Practice Act (Chapter 1001)

The Texas Engineering Practice Act defines the practice of engineering as the performance of service or creative work requiring engineering education, training, and experience in the application of special knowledge of the mathematical, physical, or engineering sciences.

For an Electrical P.E., the authorized scope of practice typically includes the design of electrical systems, control systems, electronics, and the analysis of electrical signals. The Act includes a strict ethical mandate: professional engineers may only practice in their areas of competence. While the "practice of engineering" is broadly defined to include "consultation, investigation, evaluation, analysis, [and] planning", these activities must be rooted in engineering principles.

Crucially, the Act provides specific exemptions for engineers regarding *other* licenses. For example, a licensed engineer practicing engineering is exempt from the requirement to hold a Private Investigator license under Chapter 1702. However, this exemption is conditional: the engineer must be *practicing engineering* while conducting the investigation. If an Electrical P.E. is hired to investigate the authenticity of a rock core photograph, they are venturing outside their licensed discipline (electrical) and into geology. If the board determines that identifying lithological fraud is not "electrical engineering," the exemption from the Private Security Act evaporates, potentially exposing the practitioner to Class A misdemeanor charges for operating an unlicensed investigations company.

2.2 The Texas Geoscience Practice Act (Chapter 1002)

The definition of the "public practice of geoscience" in Texas is expansive. It includes the "science of the earth and its origin and history, the investigation of the earth's environment and its constituent soils, rocks, minerals, fossil fuels, solids, and fluids".

The core value proposition of Veritas Geo-Forensics involves analyzing reports that characterize the subsurface—specifically oil and gas reservoirs. If the firm issues a report stating, "*The porosity values in this report do not match the lithology shown in the core photograph*," the firm is making a geoscientific interpretation. Under Texas Occupations Code §1002.251, this requires a Professional Geoscientist (P.G.) license.

Engineers often rely on the "incidental practice" defense. Texas law acknowledges that engineering and geoscience overlap, and an engineer may perform geoscientific work that is "incidental" to an engineering project. However, this defense faces two fatal flaws in this specific business context:

1. **Nature of the Work:** The analysis of the geological report is the *primary* service being sold, not an incidental component of an electrical design project.
2. **Competence:** An Electrical Engineer typically lacks the academic background (stratigraphy, sedimentology, structural geology) to demonstrate competence in geological interpretation.

Therefore, reliance solely on an Electrical P.E. license to offer services that critique geological data is legally perilous. It invites disciplinary action from both the Texas Board of Professional Engineers and Land Surveyors (TBPELS) for practicing outside one's competence and the Texas Board of Professional Geoscientists (TBPG) for unlicensed practice.

2.3 The Private Security Act (Chapter 1702)

The third regulatory pillar is the Texas Private Security Act, which regulates private investigators. The statute defines an "investigation" broadly, including accepting employment to secure evidence for use in court or to determine the "truth or falsity of any statement".

Analyzing a report to determine if it is fraudulent falls squarely within the definition of determining the "truth or falsity of any statement." Consequently, unless an exemption applies, the firm must hold a Class A Investigations Company license, and the founder must be a licensed Private Investigator or a "Qualified Manager" for the firm.

The "Computer Forensics" nuance is critical here. For years, Texas regulators have grappled with whether computer repair and digital forensics constitute private investigation. The current interpretation suggests that while mere data retrieval (recovering a lost file) is not investigation, the *analysis* of that data to find evidence of misconduct (e.g., fraud) *is* a regulated investigative activity. Since Veritas Geo-Forensics intends to analyze digital files (PDFs, JPEGs) to uncover deception, this likely triggers the licensure requirement.

2.4 Strategic Recommendation: The Hybrid Compliance Model

To operate legally and credibly, the business cannot rely on the Electrical P.E. license alone. A hybrid compliance strategy is required:

1. **The "Data Scientist" Positioning:** The firm should define its scope of practice as "Digital Data Forensics and Document Integrity Verification." The deliverables should focus on objective data anomalies (e.g., "Image A is a pixel-for-pixel duplicate of Image B from the public record") rather than subjective geological opinions (e.g., "This formation is not productive").
2. **Strategic Partnership:** To offer the high-value "Geological Validation" service, the firm must partner with or employ a licensed Professional Geoscientist (P.G.). This individual would seal the geological portions of the report, while the P.E. (founder) or a CFE (Certified Fraud Examiner) would sign off on the data integrity and fraud risk assessment.
3. **Investigations License:** Obtaining a Class A Investigations Company license is the safest route to avoid regulatory friction. If the founder does not meet the 3-year experience requirement for a

"Qualified Manager" , they may need to hire a licensed PI to serve in that role during the startup phase.

3. The Anatomy of Oil & Gas Fraud

Understanding the mechanisms of fraud is essential to designing the detection algorithms. Oil and gas fraud relies on the complexity of the subject matter to obfuscate the deception.

3.1 The "Salted" Sample: Physical vs. Digital

Historically, "salting" involved adding gold dust to rock samples to inflate assay results, as seen in the Bre-X scandal, where core samples were physically tampered with. In the modern oil and gas context, physical salting is rare due to the chain of custody controls in major labs. However, "Digital Salting" is rampant.

Digital salting involves the misappropriation of favorable data from a high-performing well to support the prospectus of a poor or undrilled prospect.

- **The Phantom Core:** A promoter selling a lease in the "fringes" of the Permian Basin might include a core photograph showing oil-saturated rock. In reality, that photograph may have been lifted from a technical paper published five years ago regarding a different well in the sweet spot of the basin.
- **Mechanism of Detection:** A human analyst might miss this, but a **Perceptual Hashing (pHash)** algorithm can detect it instantly. Unlike cryptographic hashes (MD5/SHA), which change completely if a single bit is altered, perceptual hashes remain similar even if the image is resized, compressed, or slightly color-corrected.

3.2 Reserve Inflation and "Paper Barrels"

Fraudsters often manipulate engineering data to inflate the Estimated Ultimate Recovery (EUR) of a well. This can involve:

- **Decline Curve Manipulation:** Altering the "b-factor" in hyperbolic decline equations to suggest that a well's production will flatten out rather than decline steeply.
- **Omission of Water Cut:** Reporting total fluid production as "oil" or failing to disclose massive water disposal costs that destroy the well's economics.
- **Misrepresentation of Acreage:** Selling "working interests" in leases that have already expired or where the primary term obligations (drilling a well by a certain date) were not met, resulting in the lease reverting to the mineral owner.

3.3 The "Phantom Well" Scheme

In extreme cases, operators may solicit funds for wells that do not exist or for which they have no permit to drill. The *Petrobridge Energy* case highlighted by the SEC involved overstating acreage and promising unrealistic returns without proper operational capability.

- **Verification Strategy:** This type of fraud is detectable by cross-referencing the state regulatory databases. Every valid well has an API (American Petroleum Institute) number. A "Phantom Well" check script would verify if the API number in the prospectus exists in the Railroad Commission (RRC) or NDIC database and if the reported status (e.g., "Drilling," "Producing") matches the state record.
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4. Technical Architecture: The "Fraudguard" Engine

The core value proposition of Veritas Geo-Forensics is its proprietary database and analysis engine. This system transforms manual due diligence into an automated, scalable product.

4.1 Data Ingestion and The "Truth Database"

The foundation of the system is the "Truth Database"—a massive repository of authenticated documents and data points against which suspect documents are compared.

Source Data Aggregation:

To build this database, the firm must systematically harvest data from public regulatory bodies.

- **North Dakota Industrial Commission (NDIC):** The NDIC offers a "Premium Subscription" (\$500/year) that provides access to scanned well files, hearing audio, and critically, a digital library of over 402,000 core photographs covering 263,000 feet of core. This is a high-value dataset for training image recognition models because the provenance of these photos is government-verified.
- **Texas Railroad Commission (RRC):** The RRC provides bulk data downloads via HTTPS, including "Well Logs," "Drilling Permits," and digital map data. While the RRC has massive amounts of data (estimated 132 million pages), much of it is in TIFF format (images of documents) rather than structured data.
- **Wyoming Oil and Gas Conservation Commission (WOGCC):** Similar to NDIC, WOGCC provides API access and bulk downloads for well data and production history.

Data Storage and Cost Management:

Storing millions of high-resolution core photos and well logs requires a tiered storage strategy to manage costs.

- **Hot Storage (Frequent Access):** Active indices and vector embeddings should be stored in low-latency environments like **Amazon OpenSearch Service** (vector engine) or **Pinecone**.
- **Cold Storage (The Archive):** The raw image files (TB scale) should reside in **AWS S3 Glacier Deep Archive** or **Azure Archive Storage**, which offer prices as low as \$0.00099 per GB/month. For a 100TB dataset, monthly storage costs could be optimized to under \$200 for the raw archive, although retrieval costs and active indexing would drive the operational budget higher.

4.2 Forensic Analysis Modules

The analysis engine consists of three primary modules:

Module A: Visual Similarity Engine (The "De-Duplicator")

This module detects if an image in a client's report has been copied from the "Truth Database."

- **Perceptual Hashing (pHash):** This algorithm converts an image into a 64-bit fingerprint based on its frequency spectrum (using Discrete Cosine Transform). It is resilient to resizing, aspect ratio changes, and minor color adjustments. If a promoter takes a core photo from a publicly available NDIC report, crops it, and puts it in a Texas prospectus, pHash will likely flag it as a match.
- **Scale-Invariant Feature Transform (SIFT):** For more complex manipulations (e.g., rotating a core photo 90 degrees or collaging multiple rocks together), SIFT identifies "keypoints" in the image that are invariant to scale and rotation. This allows the system to find a "sub-image" match—for instance, identifying that a specific 6-inch section of rock in a prospectus matches a 30-foot core slab in the database.

Module B: Document Integrity Engine

This module analyzes the PDF file structure itself.

- **Metadata Analysis:** Examining the creation dates, author tags, and modification history of the PDF. A "Geology Report" dated 2024 but containing metadata showing creation in 2018 is a red flag.
- **Error Level Analysis (ELA):** ELA detects image manipulation by analyzing compression artifacts. If a section of a log curve was "erased" and redrawn in Photoshop, the compression level of the altered pixels will differ from the background, creating a visual signature of the forgery.

Module C: Regulatory Cross-Check

This module uses Optical Character Recognition (OCR) to extract API numbers, lease names, and legal descriptions from the document. It then queries the state APIs (RRC, NDIC) to verify:

- Does the API number exist?
- Does the operator listed in the report match the operator of record?
- Is the lease status "Active" or "Expired"?

5. Case Study Simulation: Validating the "Muller 1-21-16H"

To illustrate the firm's value proposition, we apply the proposed forensic methodology to the documents associated with the **Muller 1-21-16H** well (File No. 20552), utilizing the data found in the provided research material.

Scenario: A client is offered a "working interest" in the Muller 1-21-16H well. The promoter provides a prospectus claiming the well is a new, unproven opportunity with "massive upside" and includes a photograph of a "proprietary core sample" allegedly taken from the well last week.

The Forensic Analysis:

1. Regulatory Status Check (The "Truth" Check):

- *System Action:* The system scrapes the API/File Number (20552) from the prospectus and queries the NDIC database.
- *Finding:* The "Truth Database" reveals that File No. 20552 corresponds to the Muller 1-21-16H, but it is *not* a new well. It was involved in a transfer of ownership from **Bruin E&P Operating, LLC** to **Enerplus Resources (USA) Corporation** effective **March 10, 2021**.
- *Red Flag:* The promoter's claim of a "new opportunity" contradicts the regulatory record of an established, transferring asset.

2. Visual Verification:

- *System Action:* The system hashes the "proprietary core photo" provided by the promoter.
- *Finding:* The system compares this hash against the NDIC library. It finds a match. The photo is actually from the **Wilson M. Laird Core and Sample Library**, specifically from a different well or the Muller well itself, but dated years prior.
- *Red Flag:* The "new" core sample is actually public archival data, misrepresented as recent proprietary data.

3. Bonding and Surety Verification:

- *System Action:* The system verifies the financial assurance listed in the transfer documents.
- *Finding:* The transfer was bonded by **Liberty Mutual Surety** (Bond No. 022225137) for **\$100,000**.
- *Insight:* This confirms the legitimacy of the *original* transfer to Enerplus. If the current promoter cannot show a similar chain of title or bonding capacity, they likely have no legal standing to sell the interest.

Conclusion for Client: The forensic report would flag the deal as "High Risk / Potential Fraud" due to the misrepresentation of asset status (Active/Transferred vs. New) and the recycling of public core imagery.

6. Financial Plan and Startup Economics

Starting a high-tech forensic firm requires significant upfront capital, primarily for data acquisition and software development. Unlike a traditional engineering consultancy that sells hours, this business sells access to an insight engine.

6.1 Startup Capital Requirements (CAPEX)

The initial capitalization required is estimated between **\$150,000 and \$280,000** for the first year, driven by the need to build the proprietary database before revenue can be realized.

- **Data Acquisition Licensing:**
 - **Enverus/Drillinginfo:** Access to their premium datasets for benchmarking is essential. Costs can range from **\$10,000 to \$27,000 per year** depending on modules (e.g., Land, Geology).
 - **State Data Fees:** While some states are free, building a comprehensive library requires budget. NDIC Premium is \$500/year; Texas RRC bulk data is free/low cost but requires massive storage.
- **Infrastructure & Software Development:**
 - **Forensic Workstations:** High-performance machines for processing large image datasets. Budget **\$100,000** for hardware if building an on-premise lab, or equivalent cloud commit spend for AWS/Azure.
 - **Cloud Costs:** Storing 100TB of image data in AWS S3 Standard would cost ~\$2,300/month. Using Glacier Deep Archive drops this to ~\$200/month, but retrieval fees apply. A hybrid approach is necessary.
 - **Commercial Forensic Tools:** Licensing tools like **Cellebrite** or **Magnet AXIOM** for digital evidence handling can cost **\$5,000 - \$15,000** annually.
- **Legal & Insurance:**
 - **Insurance:** Professional Liability (E&O) for engineers/consultants in Texas averages **\$2,000 - \$4,000/year**, but adding "investigative" riders may increase this. General Liability is ~\$450/year.
 - **Licensing Fees:** Texas Engineering Firm Registration (\$150) plus Private Investigations Company License (\$350+).

6.2 Pricing Strategy and Revenue Model

To sustain the high fixed costs of data management, the firm should move away from pure hourly billing toward value-based and retainer pricing.

- **The "Deal Shield" Retainer (\$5,000 - \$10,000/month):** Targeted at Family Offices and PE firms. Covers the automated screening of all incoming deal flow (up to a volume cap). This ensures steady cash flow and integrates the firm into the client's standard workflow.
- **The Forensic Deep Dive (\$15,000 - \$25,000 per deal):** A comprehensive audit of a specific high-value transaction. Includes physical file review, cross-referencing all data points, and a signed report by a P.E. (for data integrity) and a partner P.G. (for geological validity).
- **Hourly Expert Witness (\$300 - \$600/hour):** For litigation support in fraud cases. This is the highest margin work but unpredictable.

7. Recommended Certifications and Strategic Growth

To solidify your standing as an expert and mitigate the risks of practicing outside your Electrical Engineering discipline, specific certifications are strongly recommended.

7.1 Certified Fraud Examiner (CFE)

The CFE credential from the Association of Certified Fraud Examiners (ACFE) is the industry standard for fraud detection.

- **Relevance:** It demonstrates competence in the *methodology* of fraud examination, financial transactions, and legal elements of fraud.
- **Impact:** Holding the CFE credential signals to clients and courts that your analysis is based on established investigative standards, not just technical engineering capability. It commands a 32% salary/fee premium in the market.
- **Path:** Requires a bachelor's degree, two years of professional experience (your engineering consulting counts), and passing the CFE Exam.

7.2 GIAC Certified Forensic Analyst (GCFA)

While the CFE covers the "investigative" mindset, the GCFA covers the "digital" skillset.

- **Relevance:** This certification focuses on advanced incident response and digital forensics. It validates your ability to handle digital evidence (PDF metadata, server logs, file hashes) in a way that preserves the chain of custody for court.
- **Differentiation:** Very few oil and gas consultants hold this certification. It positions you as a uniquely capable "Cyber-Physical" investigator who understands both the rocks and the data files that represent them.

7.3 Petroleum Engineering (Optional)

You asked if you should get a P.E. in a different field. While a Petroleum P.E. would be valuable for reservoir analysis, the "experience" hurdle is significant (typically 4 years of verifiable work under a Petroleum P.E.). Given your goal is to build a *business*, your time is better spent building the *database* and acquiring the CFE/GCFA credentials, while partnering with an existing Petroleum P.E. or P.G. for the domain-specific signing authority.

8. Conclusion

The proposed business is viable, timely, and scalable. The oil and gas industry's reliance on digital data rooms has created a vulnerability that your forensic approach can address. However, success depends on strictly respecting the boundaries of your Electrical P.E. license while building the necessary infrastructure to support "Data Integrity" services.

Action Plan:

1. **Incorporate:** Form a PLLC or LLC.

2. **Register:** Register as a **Texas Engineering Firm** (\$150) and apply for a **Class A Investigations Company** license (\$350+).
3. **Certify:** Begin the CFE certification process immediately.
4. **Build:** Start aggregating the "Truth Database" from NDIC and RRC sources.
5. **Partner:** Establish a working relationship with a licensed Professional Geoscientist to cover the geological scope of your reports.

By executing this plan, Veritas Geo-Forensics can become the standard-bearer for truth in energy investing, protecting capital from the "phantom wells" and "salted data" of the modern era.